

Quality Assurance

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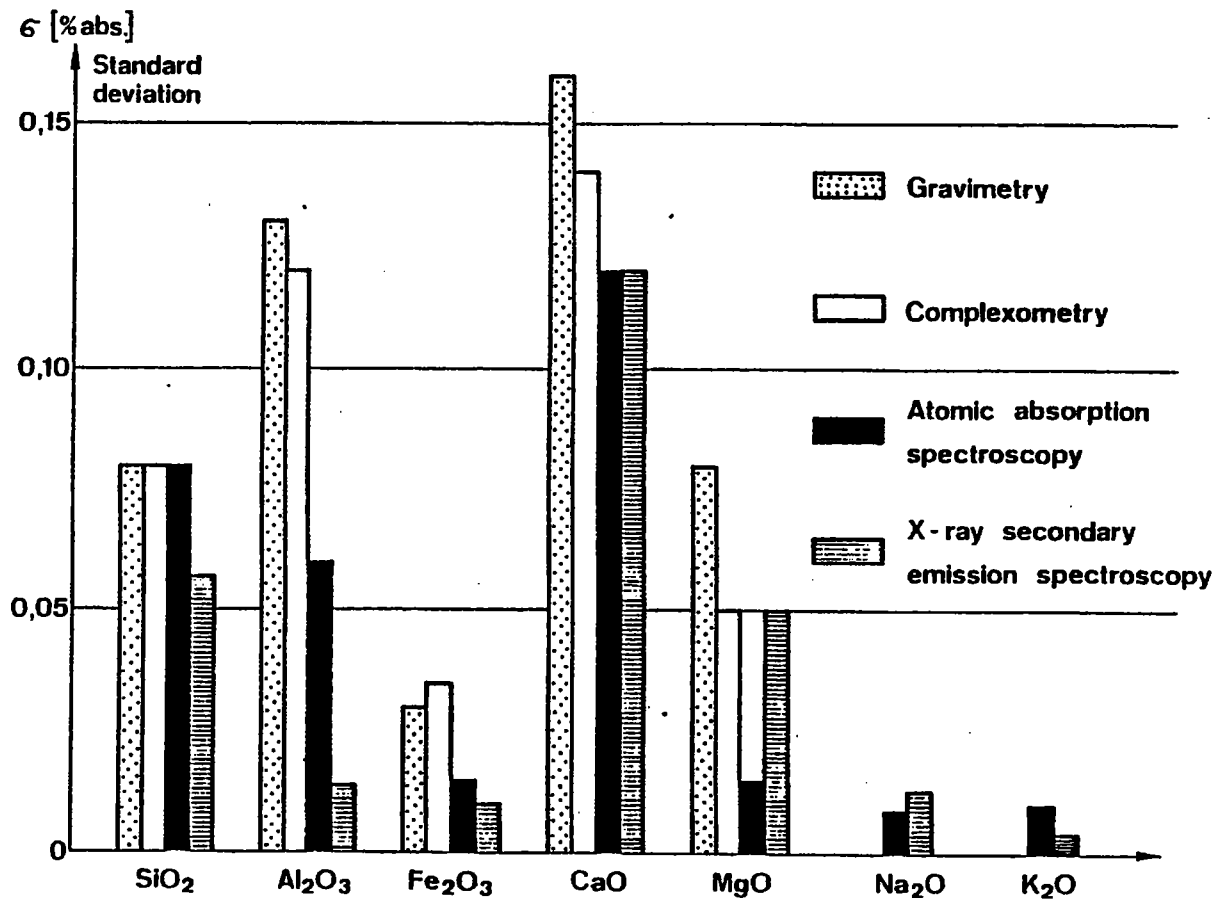
1. SCOPE OF TESTING

- ◆ Production control
- ◆ Quality Control (due to standard specifications)
- ◆ Material technological investigations
 - project planning
 - application
 - research & development

METHODS OF CHEMICAL CONTROL

Method	Criteria			
	Investment	Information	Times of analysis	Personnel
Titration	Very little	∑ Of carbonates	Minutes	Few, trained
Gravimetry volumetry	Little	Main elements LS, SR, AR; BOGUE	Many hours	Several, trained
Complexometry colorimetry	~ \$10'000	CaO, Al ₂ O ₃ , Fe ₂ O ₃ , MgO	Approx. 2 - 3 Hrs.	Several, trained
AAS	~ \$30'000	All elements except S, Cl, F, P	Approx. 2 - 3 Hrs.	Several + specialist
XRF	~\$250' 000	All elements + complete automation (off or online)	Minutes	Few + specialist

Fig. 1 Standard deviations for clinker analyses by different analytical techniques.



2. TYPES OF XRF-SPECTROMETERS

- ◆ Wavelength dispersive (WLD)
 - Sequential Mode
 - Simultaneous ('Mull) Channel') mode
- ◆ Energy dispersive (ED)
- ◆ Low cost (200 W) WLD Systems
- ◆ Bench-top XRF analysers
- ◆ Continuous ('on-line') XRF analysers

3. X-RAY FLUORESCENCE SPECTROMETERS LOW COST EQUIPMENT (200 W)

- ◆ ADVANTAGES:
 - Moderate purchase costs
 - Lower operational cost
 - Simple operation and maintenance

◆ **DISADVANTAGES:**

- Less sensitive
- Increased! measuring time
- Frequent re-calibration
- No trace element analyses

4. ANALYTICAL TRENDS IN XRF

- ◆ Trace element analyses
- ◆ Chemical analysis of liquids
- ◆ Analysis of carbon
- ◆ Sulphide/sulphate analysis

5. ADDITIONAL METHODS

- ◆ Sulphur analyser
- ◆ Carbon analyser
- ◆ Coal analyser
 - calorimeter
 - proximate analysis
- ◆ Free lime
 - Conductometric
 - X-ray diffraction

6. ADDITIONAL ANALYTICAL EQUIPMENT

- ◆ delivery control of waste
- ◆ emission control
- ◆ XRF (additional channels or sequential mode)
or
AAS → trace elements in liquids/solids
- ◆ Ion chromatography or ion-sensitive electrodes
 - halogens (chlorine, fluorine, bromine)
- ◆ flash point determination
- ◆ viscometer
- ◆ gas chromatography
 - organic compounds (PCB's etc.) bomb calorimeter (automatic)

7. ADDITIONAL ANALYTICAL EQUIPMENT

- ◆ gas chromatography with mass spectrometer
 - emission control on stack gas (organic compounds, volatile toxic elements etc.)